ClinicalEvidence

Halitosis

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ABSTRACT

INTRODUCTION: Halitosis can be caused by oral disease, or by respiratory tract conditions such as sinusitis, tonsillitis, and bronchiectasis, but an estimated 40% of affected individuals have no underlying organic disease. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatments in people with physiological halitosis? We searched: Medline, Embase, The Cochrane Library, and other important databases up to July 2008 (Clinical evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found five systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: artificial saliva; cleaning, brushing, or scraping the tongue; diet modification; regular or single use of mouthwash; sugar-free chewing gums; and zinc toothpastes.

QUESTIONS

INTERVENTIONS

Key points

- Halitosis can be caused by oral disease, or by respiratory tract conditions such as sinusitis, tonsillitis, and bronchiectasis, but an estimated 40% of affected people have no underlying organic disease.

  The main chemicals causing the odour seem to be volatile sulphur compounds, but little is known about the cause of physiological halitosis.
- Regular use of a mouthwash may reduce breath odour compared with placebo, but single-use mouthwash may have only a short-term benefit.
- We don't know whether tongue cleaning, sugar-free chewing gums, zinc toothpastes, artificial saliva, or dietary modification reduce halitosis, as no studies of adequate quality have been found.

DEFINITION

Halitosis is an unpleasant odour emitted from the mouth. It may be caused by oral conditions, including poor oral hygiene, and periodontal disease, [1] [2] or by respiratory tract conditions, such as chronic sinusitis, tonsillitis, and bronchiectasis. In this review, we deal only with physiological halitosis (i.e. confirmed persistent bad breath in the absence of systemic, oral, or periodontal disease). We have excluded halitosis caused by underlying systemic disease that would require disease-specific treatment, pseudo-halitosis (in people who believe they have bad breath but whose breath is not considered malodourous by others), and artificially induced halitosis (e.g. in studies requiring people to stop brushing their teeth). This review is only applicable, therefore, to people in whom such underlying causes have been ruled out, and in whom pseudo-halitosis has been excluded. There is no consensus regarding duration of bad breath for the diagnosis of halitosis, although the standard organoleptic test for bad breath involves smelling the breath on at least two or three different days. [1]

INCIDENCE/ PREVALENCE

We found no reliable estimate of prevalence, although several studies report the population prevalence of halitosis (physiological or because of underlying disease) to be about 50%. [1] [3] [4] [5] One cross-sectional study of 491 people found that about 5% of people with halitosis have pseudo-halitosis and about 40% have physiological bad breath not caused by underlying disease. [6] We found no reliable data about age or sex distribution of physiological halitosis.

AETIOLOGY/ RISK FACTORS We found no reliable data about risk factors for physiological bad breath. Mass spectrometric and gas chromatographic analysis of expelled air from the mouths of people with any type of halitosis have shown that the principal malodorants are volatile sulphur compounds, including hydrogen sulphide, methyl mercaptan, and dimethyl sulphide. [7] [8]

PROGNOSIS We found no evidence on the prognosis of halitosis.

AIMS OF INTERVENTION To improve social functioning; to reduce embarrassment; to reduce odour, with minimum adverse effects.

OUTCOMES Breath odor, measured by organoleptic test scores or other odour scales; quality of life including embarrassment and social functioning; adverse effects. We excluded non-clinical outcomes such as gas chromatography and spectroscopy results, and concentrations of compounds in exhaled air.

METHODS *Clinical Evidence* search and appraisal July 2008. The following databases were used to identify studies for this systematic review: Medline 1966 to July 2008, Embase 1980 to July 2008, and The Cochrane Database of Systematic Reviews and Cochrane Central Register of Controlled Clinical Trials 2008, Issue 2 (1966 to date of issue). An additional search was carried out of the NHS Centre for Reviews and Dissemination (CRD) — for Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using predetermined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews of RCTs and RCTs in any language, and containing more than 20 individuals of whom more than 80% were followed up. There was no minimum length of follow-up required to include studies. We excluded all studies described as "open", "open label", or not blinded unless blinding was impossible. We included systematic reviews of RCTs and RCTs where harms of an included intervention were studied, applying the same study design criteria for inclusion as we did for benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the MHRA, which are added to the reviews as required. We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 14). The categorisation of the quality of the evidence (high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the Clinical Evidence population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION What are the effects of treatments in people with physiological halitosis?

OPTION REGULAR-USE MOUTHWASH (CONTAINING CHLORHEXIDINE, ZINC, HYDROGEN PEROXIDE, OR OTHER ANTIMICROBIAL AGENTS)

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- Regular use of a mouthwash may reduce breath odour compared with placebo.

Benefits and harms

Regular-use mouthwash versus placebo:

We found three RCTs. [9] [10] [11] The first RCT compared an active-treatment mouthwash (containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate) versus a placebo mouthwash. The mouthwashes were used twice daily for 2 weeks. [9] The second RCT compared four mouthwashes used twice daily for 4 weeks: one containing essential oils; one containing cetylpyridinium chloride; one containing chlorine dioxide plus zinc; and a placebo mouthwash (composition not reported). [10] The third RCT compared three interventions over 4 weeks: mouthwash containing zinc chloride plus sodium chlorite; mouthwash containing zinc chloride alone; and placebo mouthwash. All participants were instructed to use mouthwash for 30 seconds twice daily. [11]

Breath odour

Regular-use mouthwash compared with placebo Regular use of a mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate or cetylpyridinium chloride alone, or zinc chloride plus sodium chlorite may be more effective than placebo at reducing breath odour at 2 to 4 weeks. However, regular use of mouthwash con-

taining essential oil or chlorine dioxide plus zinc may be no more effective at reducing breath odour at 2 weeks (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[9] RCT	40 people	**Mean odour score change from baseline , 2 weeks** –1.3 with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate –0.2 with placebo mouthwash The mouthwashes were used twice daily for 2 weeks, and breath odour was assessed on a scale from 0 (no halitosis) to 5 (offensive halitosis) by one trained examiner	P <0.005	○○○	regular-use mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate
[10] RCT **4-armed trial**	99 people The remaining arms evaluated chlorine dioxide plus zinc mouthwash and essential oil mouthwash	**Mean odour score change from baseline , 4 weeks** –0.41 with mouthwash containing cetylpyridinium chloride +0.16 with placebo mouthwash The mouthwashes were used twice daily for 4 weeks, and breath odour was assessed on a scale from 0 (no halitosis) to 5 (offensive halitosis) by two experienced examiners	P <0.05 for cetylpyridinium chloride mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention to treat	○○○	regular-use mouthwash containing cetylpyridinium chloride
[10] RCT **4-armed trial**	99 people The remaining arms evaluated mouthwash containing cetylpyridinium chloride and essential oil mouthwash	**Mean odour score change from baseline , 4 weeks** +0.06 with chlorine dioxide plus zinc mouthwash +0.16 with placebo mouthwash The mouthwashes were used twice daily for 4 weeks, and breath odour was assessed on a scale from 0 (no halitosis) to 5 (offensive halitosis) by two experienced examiners	P value reported as not significant for chlorine dioxide plus zinc mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention to treat	⟷	Not significant
[10] RCT **4-armed trial**	99 people The remaining arms evaluated mouthwash containing cetylpyridinium chloride and chlorine dioxide plus zinc mouthwash	**Mean odour score change from baseline , 4 weeks** 0 with essential oil mouthwash +0.16 with placebo mouthwash The mouthwashes were used twice daily for 4 weeks, and breath odour was assessed on a scale from 0 (no halitosis) to 5 (offensive halitosis) by two experienced examiners	P value reported as not significant for essential oil mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention to treat	⟷	Not significant
[11] RCT **3-armed trial**	48 people The remaining arm evaluated regular-use mouthwash containing zinc chloride only	**Organoleptic breath scores , 4 weeks** with regular-use mouthwash containing zinc chloride plus sodium chlorite with placebo mouthwash Absolute results reported graphically	Reported as significant for zinc chloride plus sodium chlorite mouthwash *v* placebo mouthwash P value not reported	○○○	regular-use mouthwash containing zinc chloride plus sodium chlorite

Quality of life

No data from the following reference on this outcome. [9] [10] [11]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[9] RCT	40 people	**Mean change in tongue discoloration score from baseline , 2 weeks** +2.8 with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate +0.3 with placebo mouthwash Assessed using the Winkel tongue discoloration index (measured in 6 tongue areas; range 0 = no discoloration to 12 = severe discoloration)	P <0.002	○○○	placebo mouthwash
[9] RCT	40 people	**Tooth staining , 2 weeks** with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate with placebo mouthwash Absolute results not reported	Reported as non-significant P value not reported	⟷	Not significant
[10] RCT **4-armed trial**	99 people	**Adverse effects , 4 weeks** with mouthwash containing cetylpyridinium chloride with chlorine dioxide plus zinc mouthwash with essential oil mouthwash with placebo mouthwash Absolute results not reported 13 people reported adverse effects such as lip blisters, localised gingival oedema, and sores (figures not reported by treatment group). The RCT reported: "it was determined that these adverse events were unlikely to be related to the product usage."	4 people were excluded or withdrew after randomisation Analysis not by intention to treat		

No data from the following reference on this outcome. [11]

Regular-use mouthwashes versus each other:

We found two RCTs. [10] [11] The first RCT compared four mouthwashes used twice daily for 4 weeks: one containing essential oils; one containing cetylpyridinium chloride; one containing chlorine dioxide plus zinc; and a placebo mouthwash (composition not reported). [10] The second RCT compared three interventions over 4 weeks: mouthwash containing zinc chloride plus sodium chlorite; mouthwash containing zinc chloride alone; and placebo mouthwash. All participants were instructed to use mouthwash for 30 seconds twice daily. [11]

Breath odour

Regular-use mouthwashes compared with each other We don't know how mouthwash containing cetylpyridinium chloride, chlorine dioxide plus zinc mouthwash, and essential oil mouthwash compare with each other at reducing breath odour at 4 weeks. Regular use of a mouthwash containing zinc chloride plus sodium chlorite may be more effective than mouthwash containing zinc chloride alone at reducing breath odour at 4 weeks (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[10] RCT **4-armed trial**	99 people The remaining arm evaluated placebo mouthwash	**Mean odour score change from baseline , 4 weeks** –0.41 with mouthwash containing cetylpyridinium chloride +0.06 with chlorine dioxide plus zinc mouthwash 0 with essential oil mouthwash The mouthwashes were used twice daily for 4 weeks, and breath odour was assessed on a scale from 0 (no halitosis) to 5 (offensive halitosis) by two experienced examiners	P value (among the 3 treatment groups) reported as not significant 4 people were excluded or withdrew after randomisation Analysis not by intention to treat	⟷	Not significant
[11] RCT **3-armed trial**	48 people The remaining arm evaluated regular-use placebo mouthwash	**Organoleptic breath scores , 4 weeks** with regular-use mouthwash containing zinc chloride plus sodium chlorite with regular-use mouthwash containing zinc chloride only Absolute results reported graphically	Reported as significant for zinc chloride plus sodium chlorite mouthwash *v* zinc chloride alone mouthwash P value not reported	○○○	regular-use mouthwash containing zinc chloride plus sodium chlorite

Quality of life

No data from the following reference on this outcome. [10] [11]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[10] RCT **4-armed trial**	99 people	**Adverse effects , 4 weeks** with mouthwash containing cetylpyridinium chloride with chlorine dioxide plus zinc mouthwash with essential oil mouthwash with placebo mouthwash Absolute results not reported 13 people reported adverse effects such as lip blisters, localised gingival oedema, and sores (figures not reported by treatment group). The RCT reported: "it was determined that these adverse	4 people were excluded or withdrew after randomisation Analysis not by intention to treat		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		events were unlikely to be related to the product usage."			

No data from the following reference on this outcome. [11]

Regular-use mouthwash versus single-use mouthwash, artificial saliva, diet modification, sugar-free gum, tongue cleaning, or zinc toothpastes:

We found no systematic review or RCTs.

Further information on studies

Comment: None.

OPTION SINGLE-USE MOUTHWASH (CONTAINING CHLORHEXIDINE, ZINC, HYDROGEN PEROXIDE, OR OTHER ANTIMICROBIAL AGENTS)

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- Single-use mouthwash may reduce breath odour compared with placebo but may have only a short-term benefit.

Benefits and harms

Single-use mouthwash versus placebo:

We found three small RCTs that compared a mouthwash after a single use versus control (distilled water or placebo). [2] [10] [12] Two RCTs compared single-use chlorine dioxide 0.1% mouthwash versus distilled water in healthy adults with confirmed oral malodour. [2] [12] The third RCT compared regular use of three active-treatment mouthwashes versus placebo mouthwash, but also reported results for breath odour after a single use (see option on regular-use mouthwash, p 2). [10] The RCT compared one mouthwash containing essential oils, one containing cetylpyridinium chloride, one containing chlorine dioxide plus zinc, and one placebo mouthwash (composition not reported).

Breath odour

Compared with placebo Single-use chlorine dioxide mouthwash may reduce odour unpleasantness and odour intensity 4 to 8 hours after use, but may be no more effective after 24 to 96 hours. Single-use cetylpyridinium chloride mouthwash may be more effective after 4 hours at reducing breath odour, but essential oil mouthwash may be no more effective (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[2] RCT	31 women	**Change in odour unpleasantness from baseline , 8 hours** from –1.25 to –0.63 with single-use chlorine dioxide mouthwash from –1.40 to –1.29 with distilled water Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	P <0.01	○○○	single-use chlorine dioxide mouthwash

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[2] RCT	31 women	**Change in odour unpleasantness from baseline , 24 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	Reported as non-significant P value >0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour unpleasantness from baseline , 48 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	Reported as non-significant P value >0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour unpleasantness from baseline , 72 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	Reported as non-significant P value >0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour unpleasantness from baseline , 96 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	Reported as non-significant P value > 0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour intensity from baseline , 8 hours** from 1.27 to 0.63 with single-use chlorine dioxide mouthwash from 1.42 to 1.29 with distilled water Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)	P <0.01	○○○	single-use chlorine dioxide mouthwash
[2] RCT	31 women	**Change in odour intensity from baseline , 24 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported	Reported as non-significant P >0.05	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)			
[2] RCT	31 women	**Change in odour intensity from baseline , 48 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)	Reported as non-significant P value >0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour intensity from baseline , 72 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)	Reported as non-significant P value >0.05	⟷	Not significant
[2] RCT	31 women	**Change in odour intensity from baseline , 96 hours** with single-use chlorine dioxide mouthwash with distilled water Absolute results not reported Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)	Reported as non-significant P >0.05	⟷	Not significant
[12] RCT **Crossover design**	12 people 96-hour washout period between treatments	**Change in odour unpleasantness score from baseline , 4 hours** from –1.25 to –0.61 with single-use chlorine dioxide mouthwash from –1.06 to –1.08 with distilled water Three examiners scored breath odour on a scale from +3 (very pleasant/fresh) to –3 (very unpleasant/stale)	P <0.01	○○○	single-use chlorine dioxide mouthwash
[12] RCT **Crossover design**	12 people 96-hour washout period between treatments	**Change in odour intensity score from baseline , 4 hours** from 1.14 to 0.81 with single-use chlorine dioxide mouthwash from 1.11 to 1.19 with distilled water Three examiners scored odour intensity from 0 (no odour) to 4 (very strong odour)	P = 0.03	○○○	single-use chlorine dioxide mouthwash
[10] RCT **4-armed trial**	99 people The remaining arms evaluated mouthwash containing chlorine dioxide and essential oil mouthwash	**Mean odour score change from baseline , 4 hours** –0.94 with single-use mouthwash containing cetylpyridinium chloride –0.22 with placebo mouthwash	P <0.05 for single-use cetylpyridinium chloride mouthwash *v* placebo	○○○	single-use cetylpyridinium chloride mouthwash

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[10] RCT **4-armed trial**	99 people The remaining arms evaluated mouthwash containing cetylpyridinium chloride and essential oil mouthwash	**Mean odour score change from baseline , 4 hours** –0.52 with single-use mouthwash containing chlorine dioxide –0.22 with placebo mouthwash	P value reported as not significant for single-use mouthwash containing chlorine dioxide *v* placebo	⟷	Not significant
[10] RCT **4-armed trial**	99 people The remaining arms evaluated mouthwash containing cetylpyridinium chloride and mouthwash containing chlorine dioxide	**Mean odour score change from baseline , 4 hours** –0.42 with essential oil mouthwash –0.22 with placebo mouthwash	P value reported as not significant for single-use mouthwash containing essential oil *v* placebo	⟷	Not significant

Quality of life

No data from the following reference on this outcome. [2] [10] [12]

Adverse effects

No data from the following reference on this outcome. [2] [10] [12]

Single-use mouthwashes versus each other:

We found one RCT (99 people), which compared regular use of three active-treatment mouthwashes versus placebo mouthwash, but also reported results after a single use (see option on regular-use mouthwash, p 2). [10] The RCT compared one mouthwash containing essential oils, one containing cetylpyridinium chloride, one containing chlorine dioxide plus zinc, and one placebo mouthwash (composition not reported).

Breath odour

Single-use mouthwashes compared with each other Single-use cetylpyridinium chloride mouthwash may improve breath odour compared with chlorine dioxide plus zinc mouthwash and essential oil mouthwash after 4 hours (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[10] RCT **4-armed trial**	99 people The remaining arm evaluated placebo mouthwash	**Mean odour score change from baseline , 4 hours** –0.94 with cetylpyridinium chloride mouthwash –0.52 with chlorine dioxide plus zinc mouthwash –0.42 with essential oil mouthwash	P <0.05 for cetylpyridinium chloride mouthwash *v* other active treatments	○○○	single-use cetylpyridinium chloride mouthwash

Quality of life

No data from the following reference on this outcome. [10]

Adverse effects

No data from the following reference on this outcome. [10]

Single-use mouthwash versus regular-use mouthwash, artificial saliva, diet modification, sugar-free gum, tongue cleaning, or zinc toothpastes:

We found no systematic review or RCTs.

Further information on studies

[2] [12] The two RCTs of chlorine dioxide mouthwash were conducted by the same research group.

Comment: None.

OPTION **ARTIFICIAL SALIVA**

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- We don't know whether artificial saliva reduces halitosis, as no trials of adequate quality have been found.

Benefits and harms

Artificial saliva:

We found no systematic review or RCTs comparing artificial saliva versus placebo or versus the other interventions covered by this review.

Further information on studies

Comment: None.

OPTION **DIET MODIFICATION (DRINKING PLENTY OF LIQUIDS; CHEWING HERBS; EATING FRESH, FIBROUS VEGETABLES SUCH AS CARROTS; AVOIDING COFFEE)**

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- We don't know whether dietary modification reduces halitosis, as no trials of adequate quality have been found.

Benefits and harms

Diet modification:

We found no systematic review or RCTs comparing dietary modification versus placebo or versus the other interventions covered by this review.

Further information on studies

Comment: None.

OPTION SUGAR-FREE CHEWING GUM

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- We don't know whether sugar-free chewing gums reduce halitosis, as no trials of adequate quality have been found.

Benefits and harms

Sugar-free chewing gum:

We found no systematic review or RCTs comparing sugar-free chewing gum versus placebo or versus the other interventions covered by this review.

Further information on studies

Comment: None.

OPTION TONGUE CLEANING, BRUSHING, OR SCRAPING

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- We don't know whether tongue cleaning reduces halitosis, as no trials of adequate quality have been found.

Benefits and harms

Tongue cleaning, brushing, or scraping:

We found no systematic review or RCTs comparing tongue cleaning versus placebo or versus the other interventions covered by this review.

Further information on studies

Comment: None.

OPTION ZINC TOOTHPASTES

- For GRADE evaluation of interventions for Halitosis, see table, p 14 .
- We don't know whether zinc toothpastes reduce halitosis, as no trials of adequate quality have been found.

Benefits and harms

Zinc toothpastes:

We found no systematic review or RCTs comparing zinc toothpastes versus placebo or versus the other interventions covered by this review.

Further information on studies

Comment: None.

GLOSSARY

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Organoleptic test scores These are assigned by one or more examiners who sniff the person's exhaled breath on two or three different days. People having this examination should not have had antibiotics in the previous 3 weeks, and should have refrained from eating garlic, onions, and spicy foods for 48 hours, and should have refrained from usual oral hygiene and smoking for the previous 12 hours. [1] Scoring systems vary among studies.

Very low-quality evidence Any estimate of effect is very uncertain.

REFERENCES

1. Yaegaki K, Coil JM. Examination, classification, and treatment of halitosis; clinical perspectives. *J Can Dent Assoc* 2000;66:257–261.[PubMed]
2. Frascella J, Gilbert RD, Fernandez P, et al. Efficacy of a chlorine dioxide-containing mouthrinse in oral malodor. *Compend Contin Educ Dent* 2000;21:241–254.[PubMed]
3. Meningaud JP, Bado F, Favre E, et al. Halitosis in 1999. *Rev Stomatol Chir Maxillofac* 1999;100:240–244. [In French][PubMed]
4. Bollen CM, Rompen EH, Demanez JP. Halitosis: a multidisciplinary problem. *Rev Med Liege* 1999;54:32–36. [In French][PubMed]
5. Tomas Carmona I, Limeres Posse J, Diz Dios P, et al. Extraoral etiology of halitosis. *Med Oral* 2001;6:40–47.[PubMed]
6. Delanghe G, Bollen C, van Steenberghe D, et al. Halitosis, foetor ex ore. *Ned Tijdschr Tandheelkd* 1998;105:314–317 [In Dutch][PubMed]
7. Tonzetich J. Direct gas chromatographic analysis of sulphur compounds in mouth air in man. *Arch Oral Biol* 1971;16:587–597.[PubMed]
8. Kleinberg I, Westbay G. Oral malodor. *Crit Rev Oral Biol Med* 1990;1:247–259. [PubMed]
9. Winkel EG, Roldan S, Van Winkelhoff AJ, et al. Clinical effects of a new mouthrinse containing chlorhexidine, cetylpyridinium chloride and zinc-lactate on oral halitosis. A dual-center, double-blind placebo-controlled study. *J Clin Periodontol* 2003;30:300–306. [PubMed]
10. Borden LC, Chaves ES, Bowman JP, et al. The effect of four mouthrinses on oral malodor. *Compend Contin Educ Dent* 2002;23:531–546.[PubMed]
11. Codipilly DP, Kaufman HW, Kleinberg I. Use of a novel group of oral malodor measurements to evaluate an anti-oral malodor mouthrinse (TriOral™) in humans. *J Clin Dent* 2004;15:98−104. [PubMed]
12. Frascella J, Gilbert R, Fernandez P. Odor reduction potential of a chlorine dioxide mouthrinse. *J Clin Dent* 1998;9:39–42.[PubMed]

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Competing interests: SRP and CS assisted in the organisation of the 6th International Conference on Breath Odour, 20–22 April 2004. Fees for time for this work were transferred to the Eastman Dental Institute.

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GRADE **Evaluation of interventions for Halitosis.**

Important outcomes				Breath odour, Quality of life					
Studies (Participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of treatments in people with physiological halitosis?									
3 (187) [9] [10] [11]	Breath odour	Regular-use mouthwash versus placebo	4	–2	0	0	NA	Low	Quality points deducted for sparse data and methodological flaws
2 (less than 147 people) [10] [11]	Breath odour	Regular-use mouthwashes versus each other	4	–2	0	0	0	Low	Quality points deducted for sparse data and methodological flaws
3 (142) [2] [10] [12]	Breath odour	Single-use mouthwash versus placebo	4	–2	–1	0	NA	Very low	Quality points deducted for sparse data and incomplete presentation of data. Consistency point deducted for conflicting results
1 (less than 99 people) [10]	Breath odour	Single-use mouthwashes versus each other	4	–2	0	0	NA	Low	Quality points deducted for sparse data and incomplete presentation of data

We initially allocate 4 points to evidence from RCTs, and 2 points to evidence from observational studies. To attain the final GRADE score for a given comparison, points are deducted or added from this initial score based on preset criteria relating to the categories of quality, directness, consistency, and effect size. Quality: based on issues affecting methodological rigour (e.g., incomplete reporting of results, quasi-randomisation, sparse data [<200 people in the analysis]). Consistency: based on similarity of results across studies. Directness: based on generalisability of population or outcomes. Effect size: based on magnitude of effect as measured by statistics such as relative risk, odds ratio, or hazard ratio.